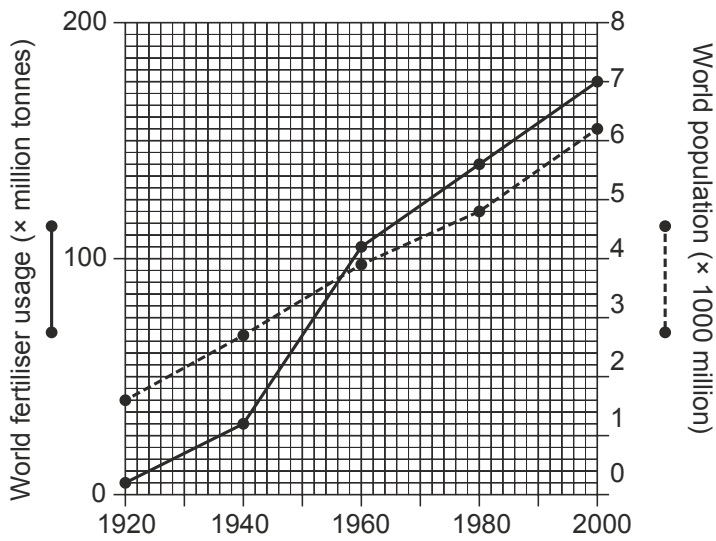


# Higher Biology

## Unit 3 Homework

### Sustainability and Interdependence

1. The graph below shows how world population and fertiliser usage changed between 1920 and 2000.



Which of the following conclusions can be drawn from these results?

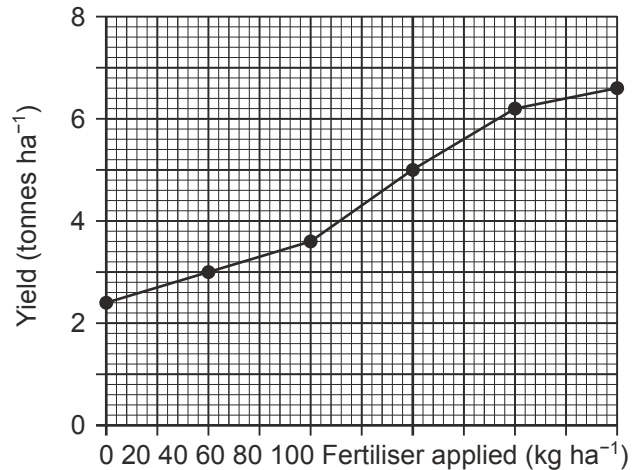
- A World fertiliser usage was 55 million tonnes in 1930.  
 B World population increased steadily between 1960 and 2000.  
 C World fertiliser usage was 140 million tonnes in 1980.  
 D World fertiliser usage first increased more rapidly than the population growth in 1956.
3. The list below gives some adaptations of weed plants.

- 1 high seed output
- 2 possession of storage organs
- 3 vegetative reproduction
- 4 long term seed viability

Which of these are competitive adaptations of annual weeds?

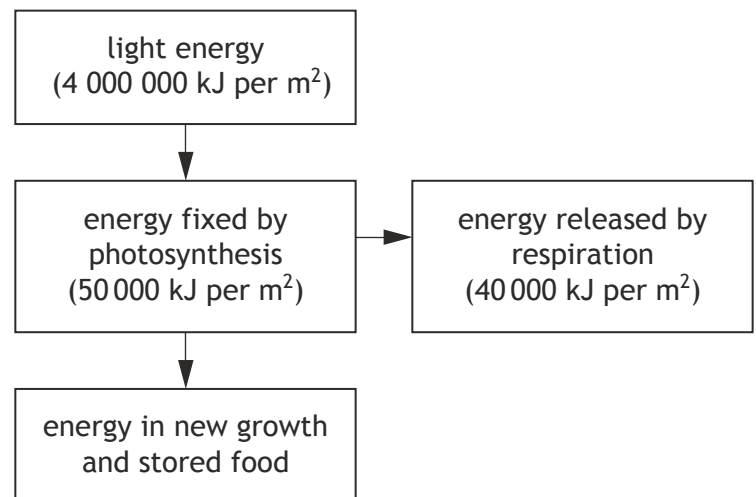
- A 1 and 2 only  
 B 1 and 4 only  
 C 2 and 3 only  
 D 2 and 4 only

2. The graph below shows the effect of applying different concentrations of fertiliser on the yield of a crop plant.



The percentage increase in yield obtained when the fertiliser application is increased from 60 to 80 kg ha<sup>-1</sup> is

- A 12%  
 B 62%  
 C 24%  
 D 124%.
4. The flow chart below shows the energy flow in a field of potatoes during one year.



What is the percentage of the available light energy present in new growth and stored food in the potato crop?

- A 2.25  
 B 1.25  
 C 0.25  
 D 1.00

5. The action spectrum of photosynthesis shows the ability of green plants to
- A use light for photolysis
  - B absorb all wavelengths of light in photosynthesis
  - C absorb different wavelengths of light in photosynthesis
  - D use light of different wavelengths for photosynthesis.

6. Which of the following results in the transfer of electrons down the electron transport chains during the light dependent reactions of photosynthesis?

- A NADP is converted to NADPH B  
Water is split by photolysis
- C ATP is synthesised
- D Pigment molecules absorb energy

7. Which of the following occurs during the Calvin cycle?

- A ATP is produced
- B Oxygen is released
- C Water is split
- D Carbon dioxide is fixed

9. The following statements refer to photosynthesis.

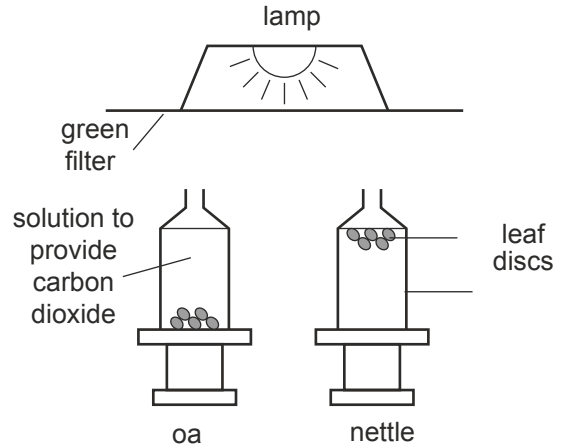
- 1 Carbon dioxide is fixed by RuBisCO.
- 2 Sugar molecules are combined to form starch.
- 3 G3P is used to regenerate RuBP.

Which of the statements correctly refer to the Calvin cycle?

- A 1 and 2 only
- B 1 and 3 only
- C 2 and 3 only
- D 1, 2 and 3

8. An investigation was carried out to compare photosynthesis in green light by oak and nettle leaves. Five leaf discs were cut from each plant and placed in syringes containing a solution to provide carbon dioxide.

The diagram below shows the positions of the leaf discs after one hour.



How could the experiment be improved to allow valid conclusions to be drawn?

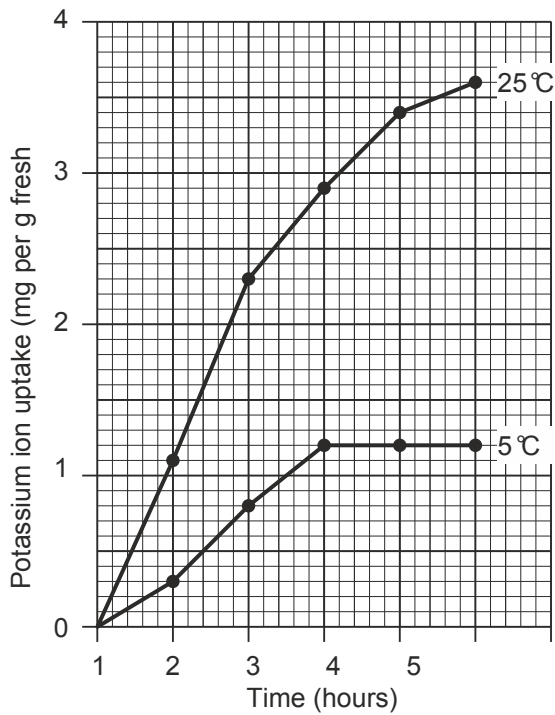
- A Carry out the experiment in a darkened room.
- B Use different species of plant.
- C Use more leaf discs.
- D Repeat the experiment.

10. The reason for replicating treatments during plant field trials is to

- A develop improved plant varieties
- B ensure fair comparisons between treatments
- C take into account variability within the plants being grown
- D eliminate bias when measuring the effects of treatments on growth.

11. In an investigation into growing conditions for carrots, the uptake of potassium ions into samples of carrot root tissue at different temperatures was measured.

The results are shown in the graph below.



11.

At 6 hours, how many times greater is the uptake of potassium ions at 25°C compared to 5°C?

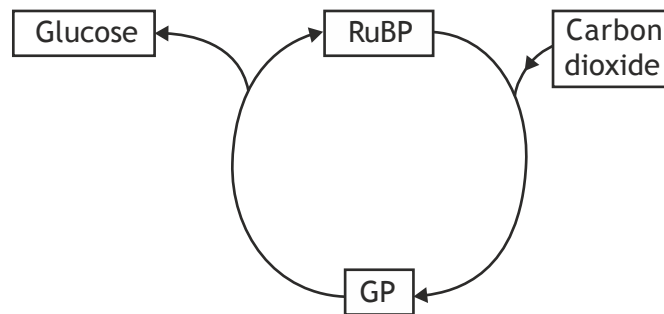
- A 1.2
- B 2.0
- C 2.4
- D 3.0

12 Crop pests may be controlled by various methods.

Which control methods are used in integrated pest management?

- A biological only
- B systemic and selective chemicals
- C selective chemicals only
- D chemical and biological

13. The diagram below represents part of the Calvin cycle within a chloroplast.



Which line in the table below shows the effect of decreasing CO<sub>2</sub> availability on the concentrations of RuBP and GP in the cycle?

	<i>RuBP concentration</i>	<i>GP concentration</i>
A	decrease	decrease
B	increase	increase
C	decrease	increase
D	increase	decrease

14. The table below shows the number of beet armyworm larvae found in plots of cotton plants. Some plots were treated with insecticide on 27 June and 1 August and other plots left untreated.

Sampling date		Number of beet armyworm larvae	
		Treated plots	Untreated plots
July	8	3	3
	15	33	2
	22	22	17
	29	42	10
August	5	120	8
	12	160	10

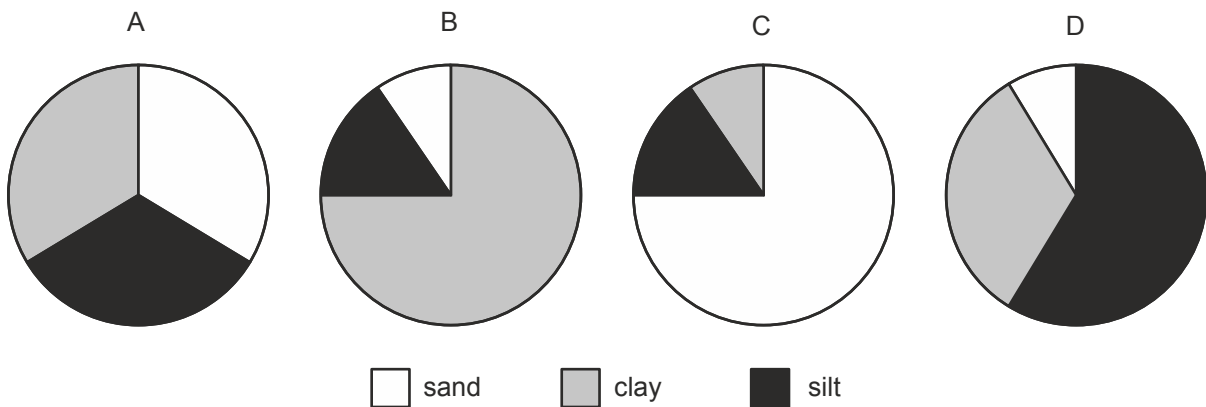
Which of the following is the most likely explanation for the differences between the treated and untreated plots?

- A The insecticide kills a predator of the larvae
  - B The larvae are resistant to the insecticide
  - C The beet armyworm breeds in July
  - D The larvae have a short lifecycle
15. Soil type is dependent on the composition of its components which in turn affects the productivity of plants growing in it.

The table below shows the percentage of each component present in four different soil types.

Soil type	Component (%)		
	clay	silt	sand
sandy clay loam	20 – 30	0 – 30	50 – 80
clay loam	20 – 35	20 – 60	20 – 50
sandy silt loam	0 – 20	40 – 80	20 – 50
silty clay loam	20 – 35	45 – 80	0 – 20

Which of the following charts represents a clay loam?



16. Adult beef tapeworms live in the intestine of humans. Segments of the adult worm are released in the faeces. Embryos that develop from them remain viable for five months. The embryos may be eaten by cattle and develop in their muscle tissue.

Which row in the table below identifies the roles of the human, tapeworm embryo and cattle?

	Role		
	human	tapeworm embryo	cattle
A	host	resistant stage	secondary host
B	host	vector	secondary host
C	secondary host	vector	host
D	secondary host	resistant stage	vector

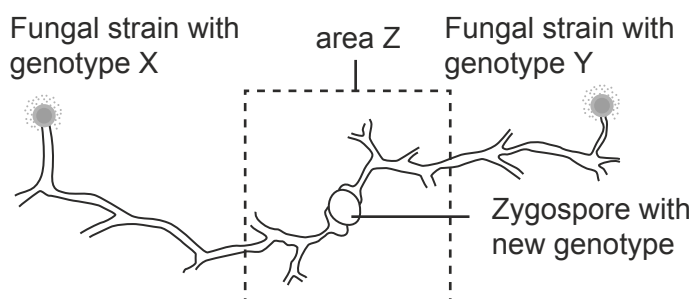
17. The list below describes observed behaviour of pigs on a farm.

- 1 Stereotypic flicking of the head
- 2 Repeated wounding of other pigs by biting
- 3 Lying in a position which does not allow suckling

Which of these behaviours indicate poor animal welfare?

- A 1 and 2 only
- B 1 and 3 only
- C 2 and 3 only
- D 1, 2 and 3

18. The diagram below shows interaction between two strains of fungi X and Y with different genotypes in an area Z.



Which statement describes the process occurring in area Z?

- A mutagenesis
- B selective breeding
- C transfer of plasmids
- D sexual reproduction

19. Which of the following are adaptations of **perennial** weeds?

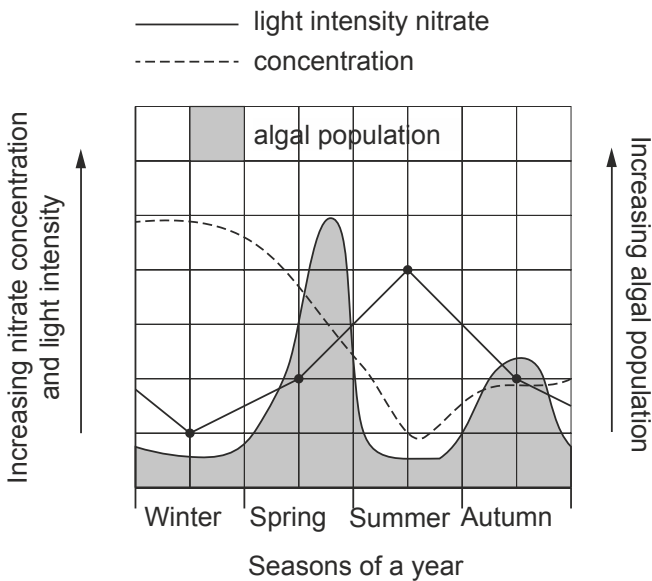
- A short life cycle and storage organs
- B storage organs and vegetative reproduction
- C high seed output and short life cycle
- D vegetative reproduction and short life cycle

20. Dandelions are weeds which often grow in grass lawns.

Which of the following could be sprayed onto a lawn to remove the dandelions?

- A non-selective herbicide
- B non-selective fungicide
- C selective herbicide
- D selective fungicide

21. The graph below shows how the population of algae in a fresh water loch was affected by the concentration of nitrate ions in the loch water and by light intensity through the seasons of a year.



Which of the following statements can be deduced from the graph?

- A The increase in algal population in spring is triggered by an increase in concentration of nitrate ions in the water.
- B The size of the algal population depends directly on the level of light intensity.
- C The increase in nitrate ion concentration in late summer is followed by an increase in algal population.
- D The algal population decreases when light intensity decreases.

22. Many varieties of garden plants grown by breeders are  $F_1$  hybrids which often show increased vigour and yield.

Further generations are not usually produced from these  $F_1$  plants because the  $F_2$  generation would be

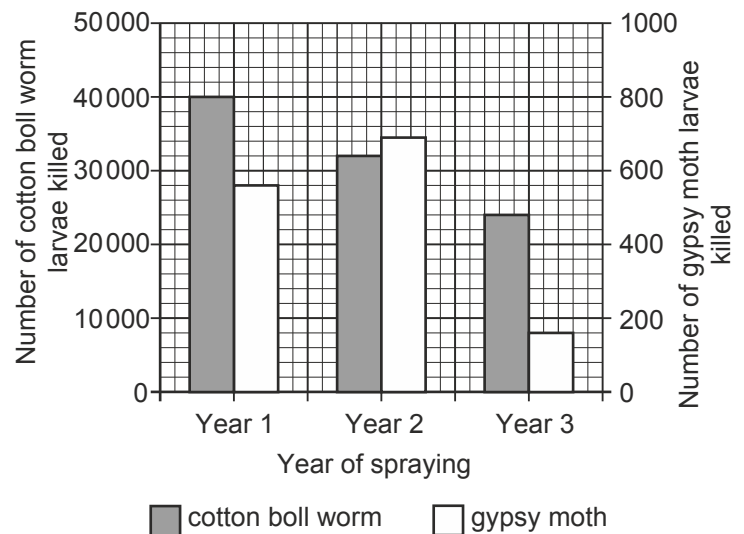
- A heterozygous
- B homozygous
- C genetically variable
- D genetically uniform.

23. A cabbage crop was sprayed with pesticide to treat an infestation of caterpillars. The concentration of pesticide was measured in the tissues of the caterpillars and of birds which ate them.

Which line in the table below shows the animal with the highest pesticide concentration in its tissues and identifies the reason for this?

	<i>Animal with highest pesticide</i>	<i>Reason</i>
A	caterpillars	pesticide is systemic
B	caterpillars	accumulation has occurred
C	birds	pesticide is systemic
D	birds	accumulation has occurred

24. The larvae of gypsy moths and cotton boll worms are pests of tree leaves. An experimental plot of infested trees was sprayed with insecticide in three different years. The numbers of each larvae killed in each year is shown in the graph below.



Which of the following conclusions can be drawn?

- A More gypsy moth larvae were killed than cotton boll worm larvae in year 2.
- B The larvae became more resistant to the insecticide each year.
- C The number of gypsy moth larvae killed was always less than cotton boll worm larvae killed.
- D The percentage of cotton boll worm larvae surviving decreased each year.

25. Domestic chickens kept in social groups form a social hierarchy in which the most dominant birds give most pecks to others and receive least.

In an investigation, four individual domestic chickens from a group were marked with lettered leg rings. The number of pecks given and received by each bird in one hour was recorded and the results shown in the table below.

		<i>Number of pecks given by each bird to the others</i>			
		Leg ring letter	W	X	Y
<i>Number of pecks received by each bird from the others</i>	W	–	0	12	9
	X	15	–	8	7
	Y	0	0	–	0
	Z	0	0	10	–

The social hierarchy among the chickens with the most dominant bird first is

- A Y, Z, W, X  
 B X, W, Z, Y  
 C Y, W, Z, X  
 D X, Z, W, Y.
26. Altruistic behaviour between closely related animals
- A reduces competition between individuals in the population  
 B increases the survival chances of the donor animal  
 C increases the frequency of shared genes in the next generation  
 D reduces unnecessary aggression and conflict in social groups.

28. The list below gives examples of benefits gained from types of behaviour in animals.

- W** increased survival of shared genes  
**X** unnecessary conflict reduced  
**Y** subordinates gain more food than by foraging alone

Which line in the table below matches correctly types of animal behaviour with the benefits they give?

	<i>Type of animal behaviour</i>		
	<i>cooperative hunting</i>	<i>appeasement</i>	<i>kin selection</i>
A	W	X	Y
B	Y	W	X
C	X	Y	W
D	Y	X	W

27. Which line in the table below best describes the effects of altruistic behaviour on the donor and the recipient?

	<i>Effect on donor</i>	<i>Effect on recipient</i>
A	benefits	benefits
B	benefits	harms
C	harms	benefits
D	harms	harms

29. In primates such as chimpanzees, parental care
- A occurs over a short time period  
 B provides time for learning complex social behaviour  
 C increases the parent's social status within their group  
 D involves appeasement behaviour within a group.



30. Flashlight fish, *Photoblepharon*, have organs beneath their eyes containing bacteria which give out light. The fish use the light to attract prey and the bacteria gain nutrients from the fish.

This is an example of

- A altruism
- B mutualism
- C parasitism
- D competition.

32. The list of statements below refers to advantages gained by hunting behaviour.

- 1 Much larger prey may be killed than by hunting alone.
- 2 Both dominant and subordinate animals benefit.
- 3 Individuals gain more energy than by hunting alone.

Which of the statements could be true of cooperative hunting?

- A 1 and 2 only
- B 1 and 3 only
- C 2 and 3 only
- D 1, 2 and 3

31. A pride of lions was studied hunting for three different prey species.

The table below shows the number of hunts carried out and the percentage of hunts that resulted in one kill.

<i>Prey species</i>	<i>Number of hunts</i>	<i>Percentage of hunts resulting in one kill</i>
Buffalo	60	15
Impala	80	30
Wildebeest	80	25

Which of the following conclusions can be drawn from this data?

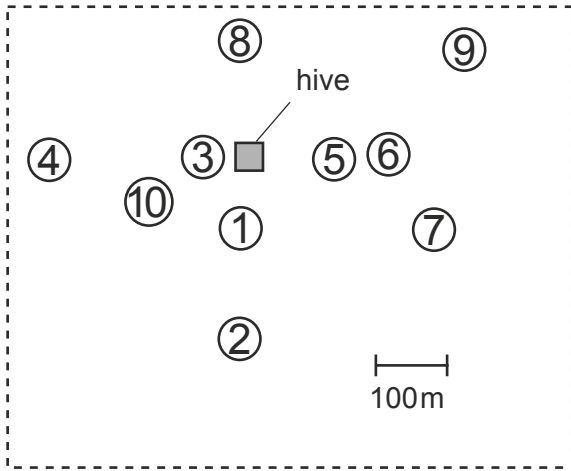
- A Cooperative hunting allows the lions to hunt more successfully.
- B Lions killed more impala than any other prey species.
- C Buffalo used social defence mechanisms most successfully.
- D More individual buffalo escaped than any other prey species.

33. Bees are social insects. The workers forage for food and indicate the distance and direction of food sources which they have located, to the rest of their hive, by dance-like movements of two different types.

The diagram below shows a hive and the location of food sources 1-10 .

The table shows the type of dance workers performed after finding sources 1-8 .

Diagram



Table

Food Source	Dance
①	round
②	waggle
③	round
④	waggle
⑤	round
⑥	round
⑦	waggle
⑧	waggle

Which line in the table indicates the dances likely to be performed by workers on finding food sources ⑨ and ⑩ ?

	Type of dance performed	
	Food Source ⑨	Food source ⑩
A	waggle	waggle
B	waggle	round
C	round	waggle
D	round	round

34. Which of the following best describes why worker honeybees from the same colony cooperate?

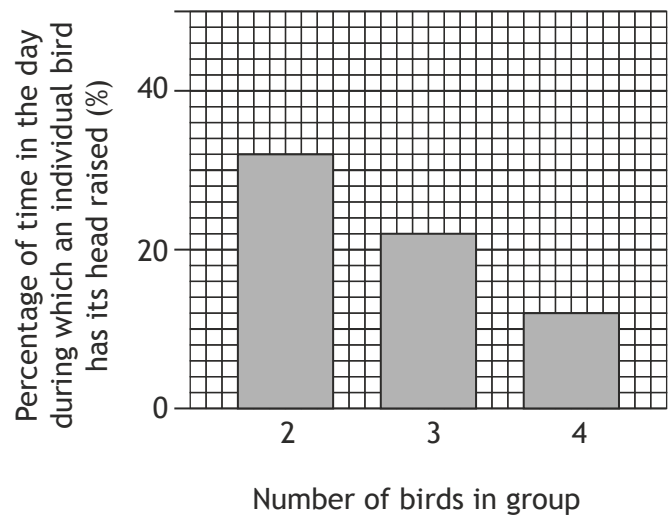
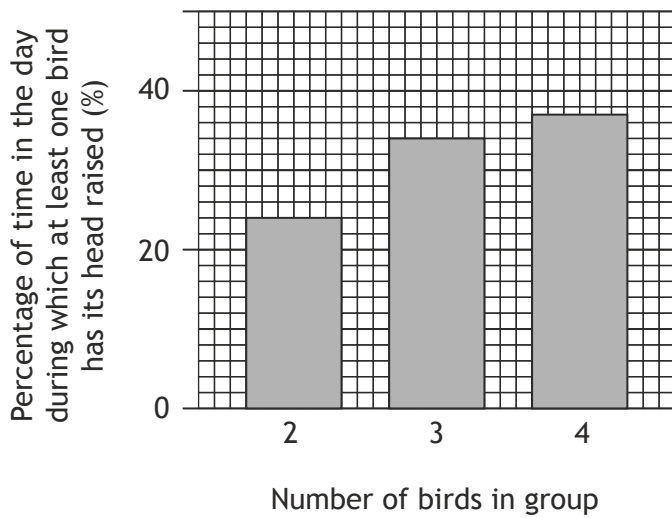
- A They are closely related.
- B They are keystone species.
- C Each individual benefits.
- D This helps them to pollinate flowers.

35. Which of the following best describes the effect of the emergence of a dominant heather species on a moorland plant community?

- A Lowers species diversity and lowers relative abundance of the dominant heather
- B Raises species diversity and raises relative abundance of the dominant heather
- C Lowers species diversity and raises relative abundance of the dominant heather
- D Raises species diversity and lowers relative abundance of the dominant heather

36. Ostriches are large birds that live on open plains in Africa. They divide their time between feeding on vegetation and raising their heads to look for predators.

The graphs below show the results of a study on the effect of group size in ostriches on their behaviour.



Which of the following is a valid conclusion from these results?

In larger groups, an individual ostrich spends

- A less time with its head raised so the group is less likely to see predators
- B less time with its head raised but the group is more likely to see predators
- C more time with its head raised so the group is more likely to see predators
- D more time with its head raised but the group is less likely to see predators.

37. The numbers of plants of five different species present in two plant communities were counted.

Community X was grazed by deer. Community Y had deer excluded by fences.

The results are shown in the table below.

Plant	Number of plants	
	Plant community X	Plant community Y
1	300	40
2	325	48
3	341	1431
4	319	32
5	315	49

Based on the information given, which comparison of plant community X with community Y is correct?

In comparison with plant community X, community Y has

- A the same species richness but a lower species diversity
- B the same species richness and a higher species diversity
- C different species richness but lower species diversity
- D different species richness and higher species diversity.

38. Mink is a naturalised mammal in many parts of the UK.

A program designed to control mink numbers in a region of Scotland was started at the end of May 2009. The population of adult animals was surveyed every three months for a year and the results are shown in the table below.

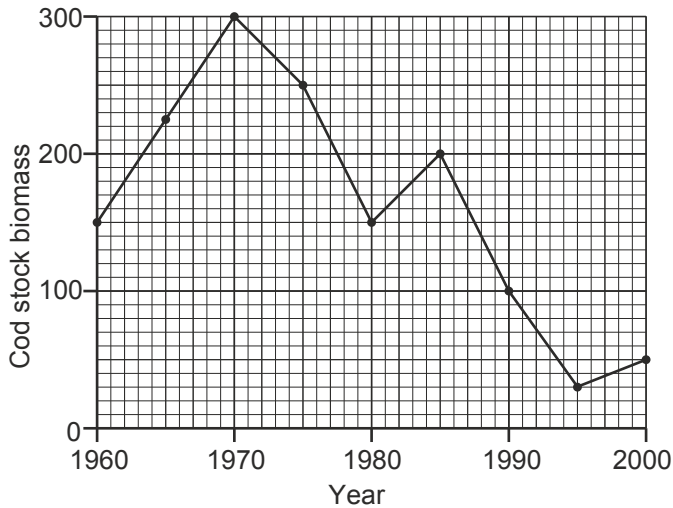
<i>Survey date</i>	<i>Population of adult mink</i>
End May 2009	1250
End August 2009	750
End November 2009	520
End February 2010	340
End May 2010	50

What was the average decrease in number of adult mink per month during the programme?

- A 100
- B 240
- C 243
- D 582

39. Cod is an important fish species which is caught for human food.

The graph below shows changes in the estimated biomass of cod stocks in a region of the North Sea between 1960 and 2000.



Which line in the table correctly shows the overall decrease in estimated cod biomass in this region in the ten year periods shown?

	<i>Ten year period</i>	<i>Decrease in estimated cod biomass in the region (tonnes)</i>
A	1960 and 1970	150
B	1970 and 1980	100
C	1980 and 1990	100
D	1990 and 2000	50

40. Northern elephant seals have very low genetic variation caused by a catastrophic decline in numbers of this species due to over-hunting by humans.

Present day animals have all descended from the small number that survived.

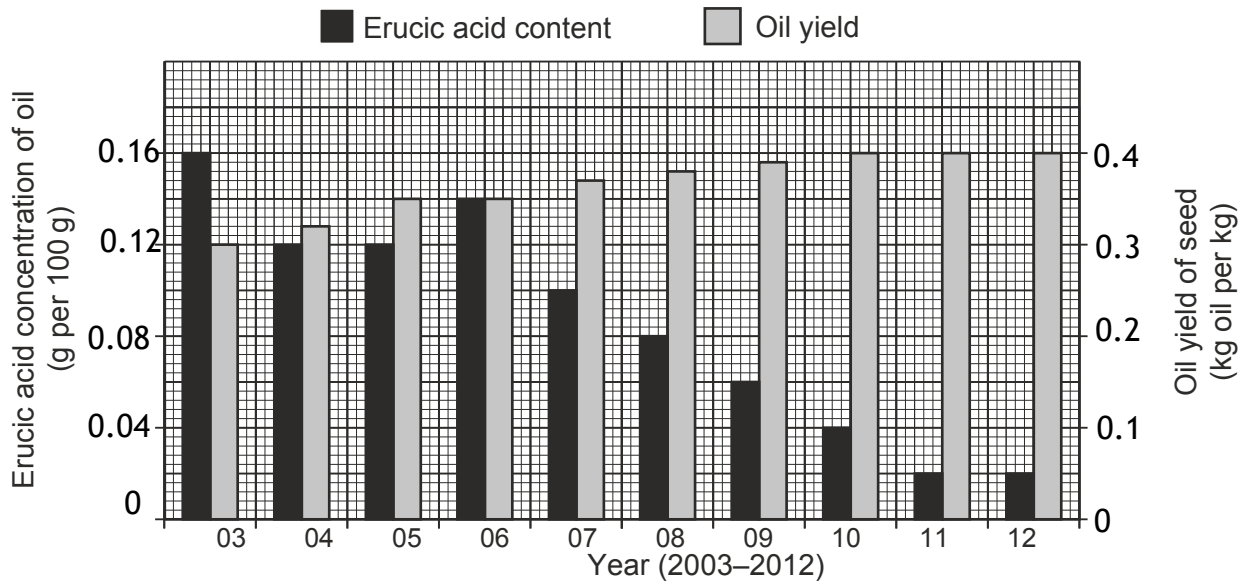
What term is used to refer to the loss of genetic variation associated with a serious decline in population?

- A Founder effect
- B Stabilising selection
- C Bottleneck effect
- D Directional selection

1. Oil from wild varieties of oilseed rape plants contains a high concentration of erucic acid which makes the oil unsuitable for human consumption.

Selective breeding programmes have produced modern varieties of oilseed rape plants with oil of low erucic acid concentration which is suitable for human consumption. In 2003 a new selective breeding programme was started which aimed to further reduce the erucic acid concentration of the oil and to increase oil content of seeds.

The **bar chart** below shows the results of the new selective breeding programme over a 10 year period.



- (a) (i) Use values from the **bar chart** to describe the changes in erucic acid concentration of the oil from 2005 until 2012. 2
- (ii) Calculate the simplest whole number ratio of the erucic acid concentration of the 2003 harvest compared with that of the 2011 harvest. 1
- (iii) Calculate the average increase per year in oil yield from 2003 to 2011. 1
- (iv) Calculate the mass of seed from 2012 which would be needed to produce one kilogram of oil. 1

- (b) The bacterium *Bacillus thuringiensis* produces Bt-toxin, a substance harmful to leaf-eating insects. Some oilseed rape plants were genetically engineered so that they contained the gene for Bt-toxin.

A field trial was set up to compare seed yields in genetically engineered plants with the Bt-toxin gene and control plants without the Bt-toxin gene. Equal numbers of the two types of plant were grown under identical conditions in the presence of leaf-eating insects and their seed yields per hectare compared.

The results of the trial are shown in the **table** below.

<i>Plants</i>	<i>Seed yield (kg per hectare)</i>
Genetically engineered (with the Bt-toxin gene)	144
Control (without the Bt-toxin gene)	80

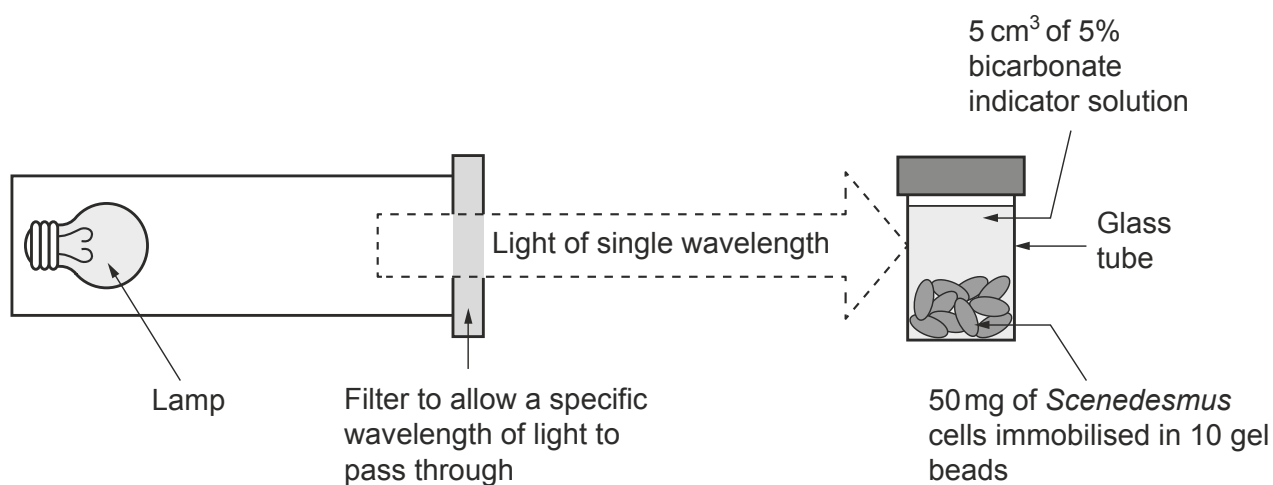
- (i) Calculate the percentage increase in the seed yield per hectare from plants with the Bt-toxin gene compared with the control plants. 1
- (ii) Explain why the genetically engineered plants produce a higher yield of seed per hectare compared with the control plants. 2
- (iii) The selectively bred plants which produced the 2012 harvest were affected by leaf-eating insects.

Using information from the **table** and the **bar chart**, predict the increase in **oil yield** per hectare which could have been achieved, if these plants had been:

- genetically engineered to contain the Bt-toxin gene 1
- grown under identical conditions to those in the field trial.

2. Photosynthesis in algal cells can be measured by immersing them in bicarbonate indicator solution. The indicator solution gradually changes colour as carbon dioxide is removed from it by photosynthesis. This colour change can be measured by placing the solution in a colorimeter. The higher the rate of photosynthesis, the higher the reading on the colorimeter.

The effect of different wavelengths of light on rate of photosynthesis in *Scenedesmus*, an algal species which grows near the surface layers of fresh water lochs, was measured. The apparatus shown below was set up in a darkened room.



After one hour, the bicarbonate indicator was removed from the tube, placed in a colorimeter and a reading taken.

The experiment was carried out seven times using different filters, each of which allowed a single wavelength of light to pass through.

The results are shown in the table below.

Filter	Wavelength of light passing through (nanometres)	Colorimeter reading (units)
1	400	0.48
2	450	0.74
3	500	0.36
4	550	0.32
5	600	0.24
6	650	0.96
7	700	0.26

- (a) Identify **two** variables, not already mentioned, that would have to be controlled to ensure that the experimental procedure was valid. 2

- (b) A control tube would be required for each wavelength of light being investigated.

Describe the contents of a suitable control tube. 1

- (c) State why the tubes were left for one hour before the colorimeter readings were taken. 1
- (d) (i) Draw a line graph to show the colorimeter readings against wavelength of light. (Collect graph paper) 2
- (ii) Give the reason why the graph of colorimeter reading against wavelength of light can be described as an action spectrum. 1
- (e) The experiment was repeated with a second alga which lives in the water below *Scenedesmus*. This species has a higher proportion of carotenoid pigments in its cells than *Scenedesmus*. 1
- Predict the colorimeter reading the indicator would give after exposure of the second alga to light of 500 nanometres and explain your answer. 1
- Prediction
- Justification



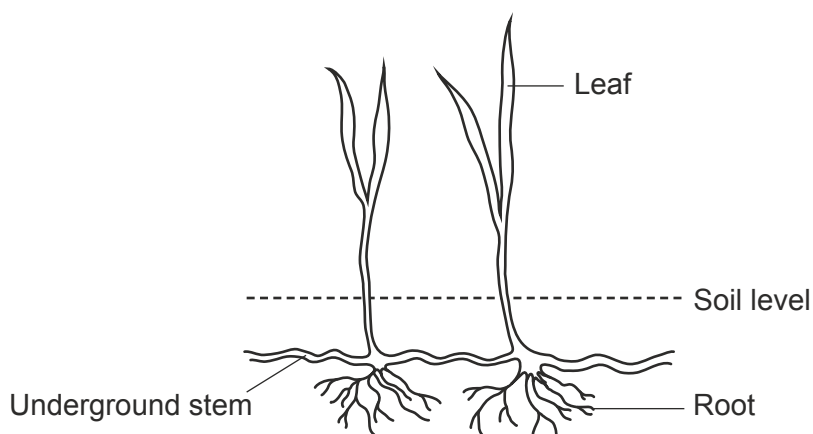
3. Nettles are shade plants which often grow below trees.

Their leaves contain photosynthetic pigments X and Y. The table below shows the percentage of light of different wavelengths absorbed by these pigments.

Wavelength of light (nm)	Colour of light	Light absorbed (%)	
		Pigment X	Pigment Y
400	violet	40	20
440	blue	60	30
550	green	5	60
680	red	50	5

- (a) Apart from being absorbed, state what else can happen to light striking the leaves of plants. 1
- (b) Identify which of the pigments, X or Y, in the table is chlorophyll. 1  
Justify your choice.
- (c) (i) Describe the relationship between the wavelength of light and the percentage of light absorbed by pigment Y. 2
- (ii) Describe how the presence of pigment Y in their leaves would benefit nettle plants growing below trees. 1

4. African couch grass is a perennial weed of crops which spreads rapidly from branching underground stems as shown in the diagram below. If the plants leaves are damaged, new leaves can grow from the underground stems.

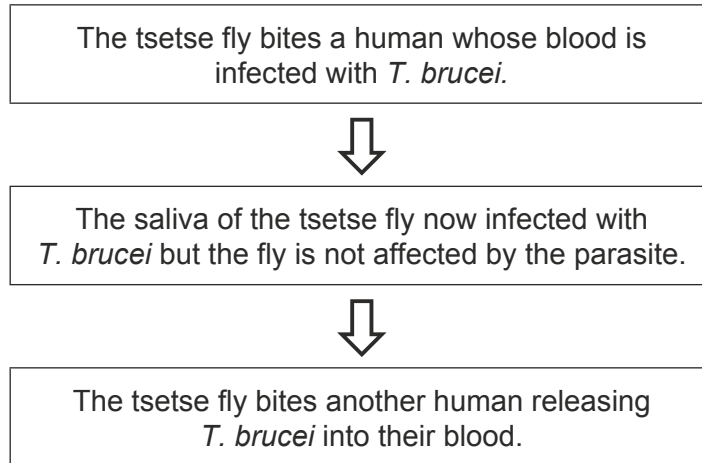


- (a) Explain why herbicide used in the control of this weed should be systemic. 1
- (b) (i) Introducing non-native insects which eat African couch grass has been suggested as a biological control. 1  
Suggest a possible risk associated with using a biological control method such as this.
- (ii) Describe what is meant by the term integrated pest management (IPM). 1

5. (a) The unicellular organism *Trypanosoma brucei* is a parasite which attacks the human nervous system causing sleeping sickness.

Sleeping sickness occurs in regions of the world such as Africa where tsetse flies are found.

The diagram below shows how the tsetse flies are involved in the transmission of sleeping sickness.



- (i) Give the meaning of the term parasite. 1
- (ii) Parasitism is one form of symbiosis. Name **one** other type of symbiosis. 1
- (iii) The tsetse fly transmits *T. brucei* from one human to another. Give the term which describes organisms which transfer parasites to hosts. 1
- (b) (i) In an effort to control sleeping sickness in a region of Africa, infertile male tsetse flies were released into wild fly populations. Suggest how this measure could reduce the number of cases of sleeping sickness in this region. 2
- (ii) The release of infertile male tsetse flies is a form of biological control. Describe **one** other form of biological control of a pest. 1
- (iii) Identify a possible risk to a food web which could be associated with the use of a biological control method. 1

6. Oxpeckers are birds which form symbiotic relationships with zebra. The oxpeckers eat parasites which live on zebra skin.

(a) (i) State the meaning of the term symbiosis. 1

(ii) Explain the benefits to both the oxpeckers and the zebra of this relationship. 1

Oxpeckers

1

Zebra

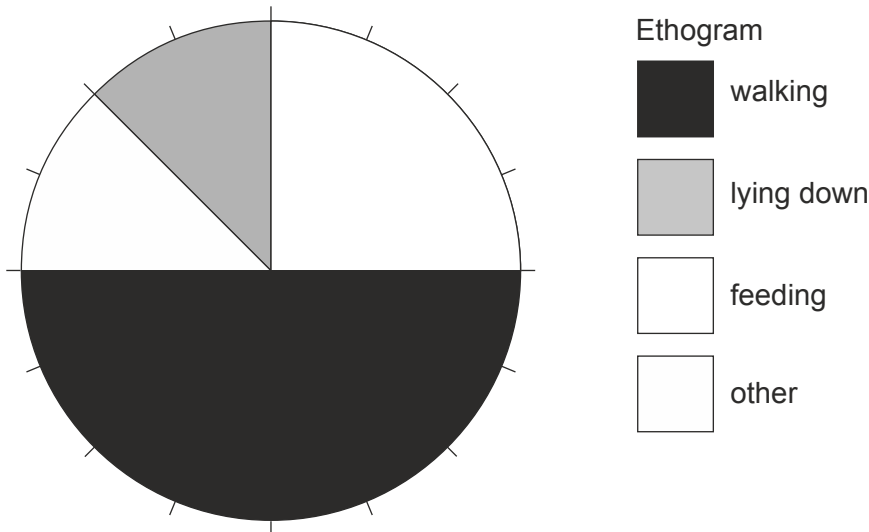
(iii) Give the term which describes symbiotic relationships that benefit both species. 1

(b) The zebra skin parasites cannot survive away from their zebra hosts and are transmitted to new hosts when zebra come into direct contact with each other.

(i) Explain why parasites cannot survive without their host. 1

(ii) Other than by direct contact, describe **one** way in which a parasite can be transmitted to a new host. 1

7. In an investigation, the behaviour of a group of pigs in an enclosure was observed. Each pig's behaviour was observed initially and then every ten seconds for twenty minutes. The behaviours observed were allocated to different categories and the results shown in the pie chart below.



- (a) Calculate how long the pigs spent feeding.

\_\_\_\_\_ minutes **1**

- (b) Express as the simplest whole number ratio the proportion of time spent walking, lying down and feeding.

*Space for calculation*

\_\_\_\_\_ walking: \_\_\_\_\_ lying down: \_\_\_\_\_ feeding **1**

- (c) Suggest **one** improvement which could be made to this investigation to improve the reliability of the results. **1**

- (d) Give **one** example of a type of behaviour which could indicate poor welfare of the pigs. **1**

8. Baboons are social primates which live in large groups.

Within a group, individuals are ranked in a social hierarchy and have complex social behaviours.

(a) Some individual baboons form alliances with others in their group to increase their social status.

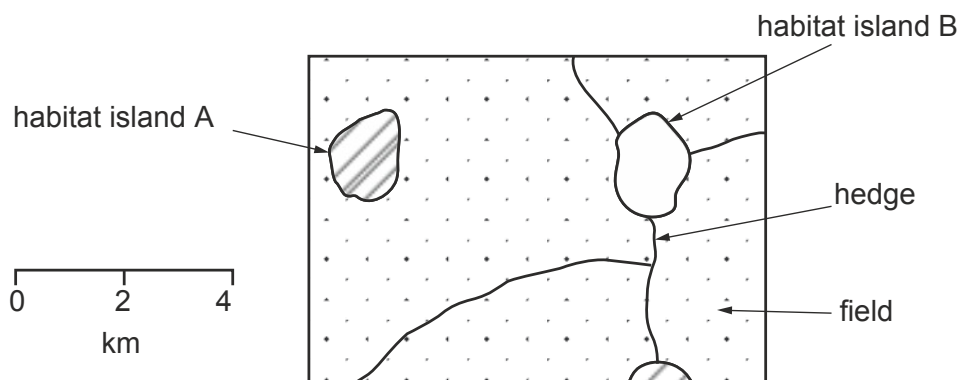
Give an example of how increased social status can benefit an individual baboon. **1**

(b) Baboons use appeasement behaviour to reduce unnecessary conflict within the group. **1**

Give **one** example of this type of behaviour.

(c) Give **one** feature of parental care in primates which allows complex social behaviour to be learned. **1**

9. Habitat islands of native forest are present in large areas of farmland in the UK. They are often connected together by the hedgerows which separate the individual fields as shown in the diagram.



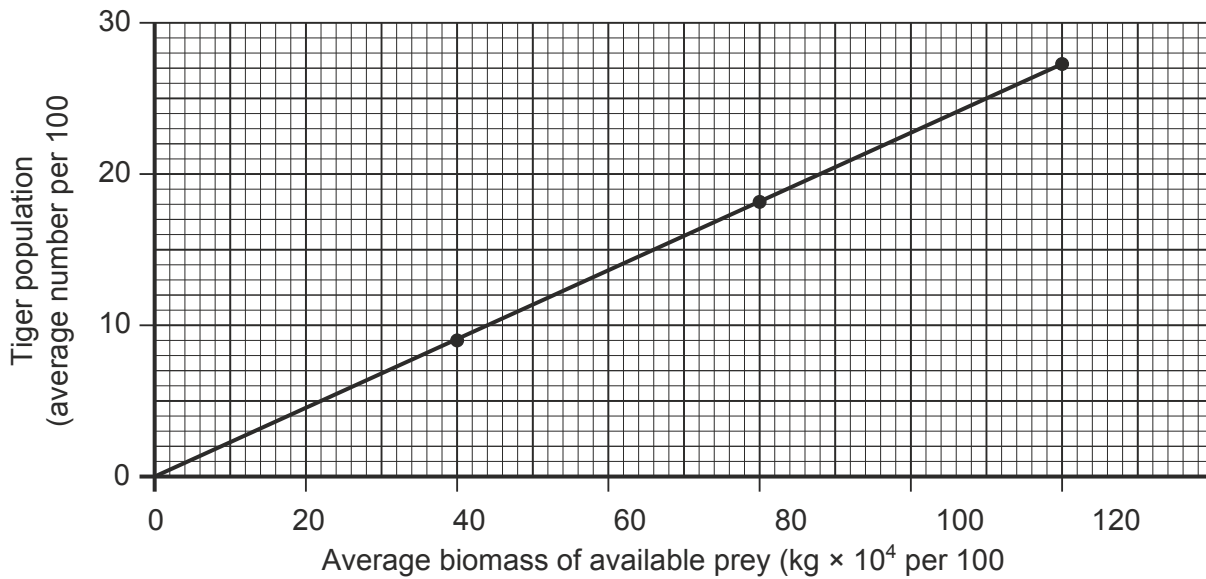
Compared with habitat island A, habitat island B has a greater species diversity. **2**

Using information from the map, explain how this has arisen.

10. The non-native shrimp *Dikerogammarus villosus* has become established in fresh water communities in the wild in Britain.
- (a) (i) Give the term used to describe non-native species which become established in wild communities. 1
- (ii) Explain why non-native species such as *D. villosus* can become established in wild communities. 1
- (iii) Describe **one** environmental problem which species such as *D. villosus* can produce when they become established in wild communities. 1
- (b) Biological control can be used to manage species which have become established in wild communities. Describe what is meant by biological control. 1
- 
11. The New Zealand flatworm is a soil-living species which was introduced to Scotland in the 1960s.
- (a) The flatworm has now become naturalised in Scotland. State what is meant by the term naturalised. 1
- (b) The flatworm population has increased more rapidly than would have been expected in its native habitat. 1  
Give **one** reason to explain why this happened.
- (c) The flatworm is now classed as an invasive species. 1  
Give **one** reason why the population of an invasive species may increase at the expense of the native species.

12. Asiatic tiger populations are monitored because the species is now endangered. One of the threats to tiger survival is reduction in prey numbers.

The graph below shows the relationship between the average population of tigers and the average biomass of their prey in their Asian habitats.



- (a) (i) Give the average tiger population per 100  $\text{km}^2$  that could be supported by an available prey biomass of  $110 \times 10^4$   $\text{kg}$  per 100  $\text{km}^2$ .

1

- (ii) Calculate the increase in average number of tigers per 100  $\text{km}^2$  as the available prey biomass increases from  $40 \times 10^4$  to  $80 \times 10^4$   $\text{kg}$  per 100  $\text{km}^2$ .

1

- (iii) From the graph, predict the average prey biomass which would be required to support a population of 30 tigers per 100  $\text{km}^2$ .

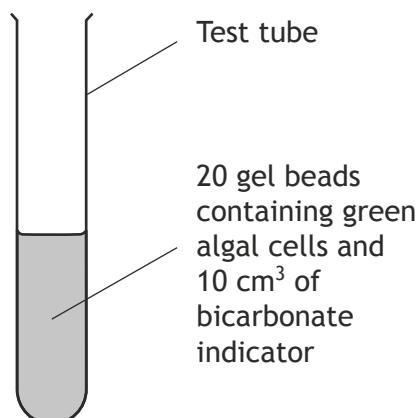
1

- (b) Habitat fragmentation has forced tiger populations into small, scattered areas of remaining habitat. The creation of habitat corridors can reduce the impact of habitat fragmentation.

Give **two** ways by which the creation of habitat corridors can reduce the impact of habitat fragmentation to tiger populations.

2

13. An investigation was carried out to compare the rate of photosynthesis, at different light intensities, of green algal cells immobilised into gel beads.



Seven tubes were set up as shown in the diagram and each positioned at a different distance from a light source to alter the light intensity.

Photosynthesis causes the bicarbonate indicator solution to change colour.

After 60 minutes, the bicarbonate indicator solution was transferred from each tube to a colorimeter.

The higher the colorimeter reading, the higher the rate of photosynthesis that has occurred in the tube.

Results are shown in the table.

<i>Tube</i>	<i>Distance of tube from light source (cm)</i>	<i>Colorimeter reading (units)</i>
1	25	92
2	35	92
3	50	83
4	75	32
5	100	14
6	125	6
7	200	0

- (a) Identify the dependent variable in this investigation. 1
- (B) Describe how the apparatus could be improved to ensure that temperature was kept constant. 1
- (c) State an advantage of using algae immobilised into gel beads. 1
- (d) Describe how the experimental procedure could be improved to increase the reliability of the results. 1
- (e) On graph paper, draw a line graph to show the colorimeter reading against distance of tube from light source. 2
- (f) From the results of this investigation, draw a conclusion about the effect of light intensity on the rate of photosynthesis. 2

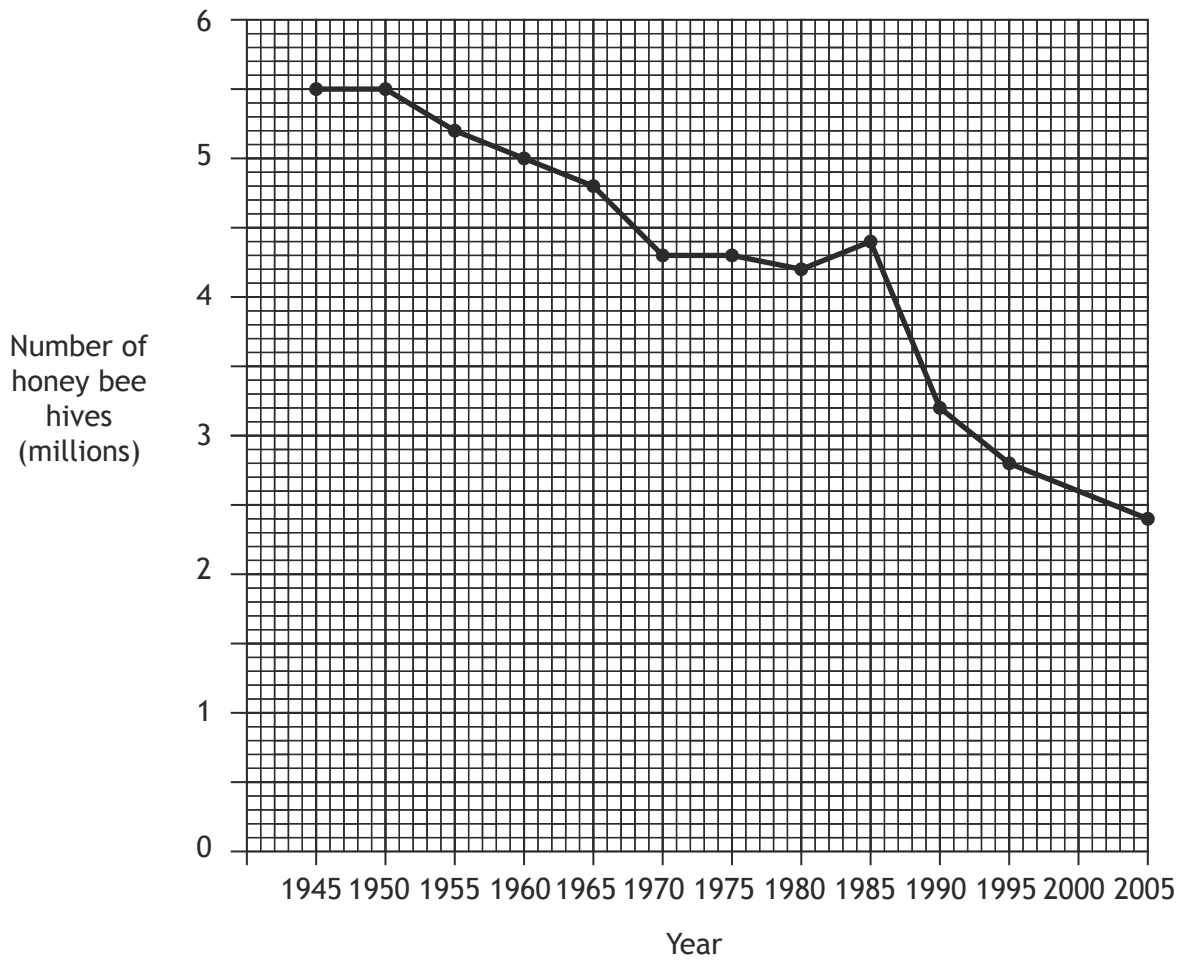


14. (a) The honey bee (*Apis mellifera*) is a social insect that lives in colonies.

The queen is the only female in a colony that reproduces. Other females are workers that collect food, maintain the colony and care for the developing offspring.

Explain the advantage to the worker bees of caring for the offspring of the queen.

2



(i) Using values from the graph, describe changes in the number of bee hives from 1980 to 1995.

1

(ii) Calculate the simplest whole number ratio of the number of bee hives in 1965 and 2005.

1

## Section C -

1. Give an account of the capture of light energy and its conversion into chemical energy in the light dependent stage of photosynthesis.
2. Write notes on photosynthesis under the following headings:
  - (i) energy capture and photosynthetic pigments;
  - (ii) use of captured energy and the light dependent stage.
3. Write notes on social behaviour under the following headings:
  - (i) altruism and kin selection;
  - (ii) primate behaviour.
4. Give an account of parasitism and mutualism as types of symbiosis.
5. Write notes on human food supply under the following headings:
  - (i) food security and population;
  - (ii) factors affecting food production.
6. Write notes on biodiversity under the following headings:
  - (i) measuring biodiversity;